Answer on the question #55580 - Chemistry - General chemistry

Question:

A particular reactant decomposes with a half-life of 145 s when its initial concentration is 0.329 M. The same reactant decomposes with a half-life of 213 s when its initial concentration is 0.224 M. What is the value and unit of the rate constant for this reaction?

Answer:

Assuming the second order of the particular decomposition reaction, the rate constant can be calculated as:

$$k = \frac{1}{[A] \cdot t_{\frac{1}{2}}}$$

Then, considering first case $t_{1/2} = 145$ s and $[A] = 0.329\ M$,

$$k = \frac{1}{0.329 \cdot 145} = 0.021\ L\ mol^{-1}s^{-1}$$

And the second case $t_{1/2} = 213$ s and $[A] = 0.224\ M$

$$k = \frac{1}{[A] \cdot t_{1/2}} = \frac{1}{0.224 \cdot 213} = 0.021\ L\ mol^{-1}s^{-1}$$

One can see, that the rate constant is the same, so the assumption about the second order of reaction is valid. So, the rate constant is equal to 0.021 L mol^{-1} s^{-1}